GENESIS AND DEFORMATION OF FIRN STRATIGRAPHY IN WEST AND EAST ANTARCTICA: EVIDENCE FROM THE US ITASE SUBSURFACE RADAR PROFILES.

Steven A. Arcone
U. S. Army ERDC-Cold Regions Research and Engineering Laboratory
Hanover, NH
Steven.A.Arcone@usace.army.mil

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Abstract

The US contribution to the ITASE program obtained shallow and deep radar profiles along its thousands of km of traverse during 1999–2003 over West Antarctica, and along its 1200 km traverse behind the Transantarctic Mountains in East Antarctica during 2006–2007. I discuss the shallow profiles, which used short-pulse radar operating at 400 MHz to profile depths of 56–135 m in West Antarctica, and at 200 MHz to depths of about 90 m in East Antarctica. Throughout West Antarctica we consistently encountered continuous and extensive layering, which I argue, is caused by thin layers of density contrasts associated with widespread hoar formation. Differential deposition rates caused by wind interacting with topography and ice movement distort these layers, with horizons changing depths by tens of meters over tens of km. In contrast, layered stratigraphy extending hundreds of km is non existent from Byrd Glacier to Titan Dome in East Antarctica. Instead, the firn consists of buried megadunes, as is the deep ice below as seen in the deep radar profiles. Their outstanding features are the prograding deposits, some of which extend over 20 km, yet originate from the relatively smaller accumulation sections, and the thick and unstratified metamorphosed zones beneath their relatively larger areas of zero accumulation glazed surfaces. These zones extended up to 35 km. The West Antarctica profiles revealed ideal sites where ITASE located its ice cores, extensive stratigraphy from which to determine spatially averaged historical accumulation rates, and an increased understanding of the more conventional accumulation processes. In contrast, most of our East Antarctica profiles will help us to understand the dynamics of a more complicated accumulation process that can provide over 20 km of horizontally oriented deposits despite apparent low accumulation rates.